

BASIC SCIENCE SERIES

1. AIR
2. EARTH
3. ELECTRICITY
4. FORCES AND MEASUREMENTS
5. HEAT
6. LIGHT
7. LIVING THINGS — ANIMALS
8. LIVING THINGS — MAN
9. LIVING THINGS — PLANTS
10. MAGNETISM
11. SOUND
12. WATER
13. ANIMALS AND THEIR YOUNG
14. SPACE AND MAN
15. LIFE IN THE SEA
16. ATOMS



BASIC SCIENCE SERIES



SOUND

REVISED
EDITION

BASIC SCIENCE SERIES — BOOK 11

REVISED EDITION

SOUND



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PREFACE

In the present technological era it is important that all children should be given a basic training in scientific knowledge. The Basic Science Series is written with this aim in mind.

The series includes 16 scientific topics each of which is a complete information book. In its entirety the scheme covers the syllabus generally adopted by upper primary classes and lower secondary forms.

The text is supported by attractive illustrations and is written in a style acceptable to a wide range of pupils.

A strong feature of each of the books is the inclusion of many simple experiments under the section "Things to Do". This encourages the pupil to keep his own project book and ultimately assists his understanding of Science.

CONTENTS

	Page
Introduction	5
How we make sounds	7
Sounds made by animals	10
How do we hear sounds?	12
How sound travels	18
How fast does sound travel?	24
Low and high sounds	26
Sounds from air	30

INTRODUCTION

The world is filled with many interesting sounds. Some are unpleasant to our ears while others are very pleasant to hear. In a single day you probably hear hundreds of different sounds.

All sounds are different. Some may be soft; others may be loud. Some sounds are high; others are low.

Some sounds are useful. Without sound we cannot talk or listen to one another. The ringing alarm clock wakes people up. The hooting of a horn on the road warns careless people of danger.

Name the sounds you can hear in these scenes.



Some sounds are harmful. Very loud sounds produced by huge planes which fly low over the land can cause damage to houses. Loud sounds will disturb people. Very loud sounds can even make people deaf or prevent them from hearing clearly.



A hooting horn warns of danger.

Things to Do

- (i) Collect as many solids as you can find, for example, coins, rocks, tins, pieces of wood and glass. Take two similar objects and knock them together. Then take different objects and knock them together. Try to make as many different sounds as possible.
- (ii) Next take two similar objects and rub them together. Then take different objects and rub them together. Try to make as many different sounds as possible.

HOW WE MAKE SOUNDS

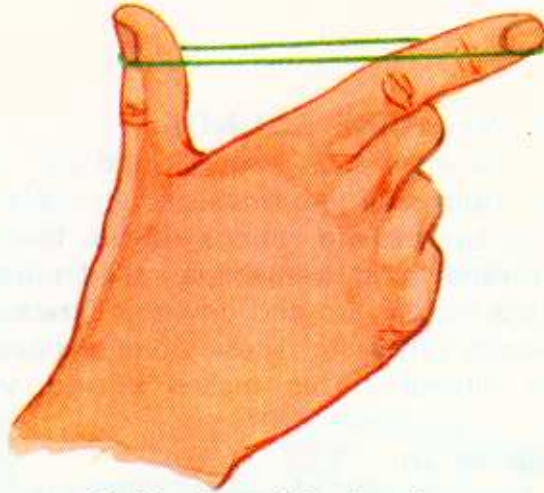
Whenever you hear a sound, find out where it comes from and what causes it. We make sounds by making things move to-and-fro. This to-and-fro movement is called **vibration**. It means moving up and down or forwards and backwards very fast. These vibrations cause the air to vibrate. This makes **sound waves**.

Things to Do

- (i) Look at this picture. Hold a long ruler on the table, so that two-thirds of the ruler is jutting off the table. Pull down on the free end of the ruler and let go. See the ruler vibrate. Can you hear a humming sound?

A vibrating ruler





A vibrating rubber band

- (ii) Take a rubber band. Hold it between your finger and thumb like this. Pluck it. What do you notice? Can you hear it humming?
- (iii) Strike a drum. You can hear the sound but you cannot see the drum moving. Put some small stones on the drum. Strike the drum again. The stones will jump up and down. This shows that the drum is vibrating.



We can make sounds in many ways e.g. by shouting, clapping our hands and banging the table. We can make sounds only by making things vibrate. Sometimes these things vibrate so fast, or so slightly, that we cannot see them vibrating.



Your voice-box is in your throat.

We can talk because we can make our **vocal cords** vibrate. Our vocal cords are in a sound-box or **voice-box**. Feel your throat gently. You can feel a hard lump. It moves up and down when you speak. This is your voice-box. Two vocal cords are stretched across it. They vibrate when your lungs force the air through them.

Things to Do

Let us make sound go through things:

- (i) Take a piece of tubing (or a pipe or hose), about one metre long, and ask your friend to hold one end to his ear. Whisper something through the other end of the tubing. Now remove the tubing and whisper to him again. Ask him whether it is easier to hear when you are whispering through the tubing or whispering without the tubing. What does this show?
- (ii) Take a clean empty tin and cup it over your mouth. Talk into it. Can the other children hear what is said? What does this show?

SOUNDS MADE BY ANIMALS

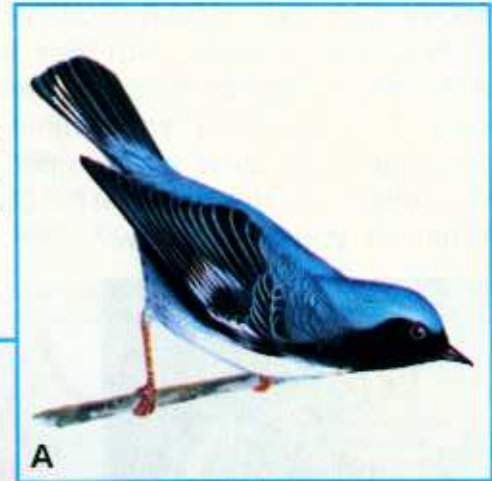
Animals can make sounds too. Different animals can make different sounds, but they all must make some part of their body vibrate.

(A) Birds can chirp and sing because they have voice-boxes. Many of them have two voice-boxes — one for singing and one for calling or warning other birds.

(B) Bees make a buzzing sound because their wings move up and down very fast. They have no voice-boxes.

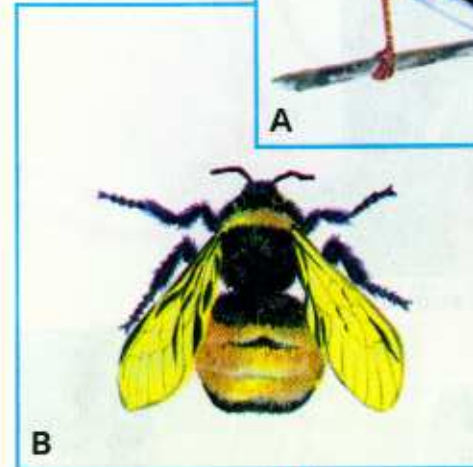
(C) Bull-frogs croak by using the voice-boxes in their throats. When they croak they puff up their throats like balloons.

Birds use their voice-boxes to chirp and sing.



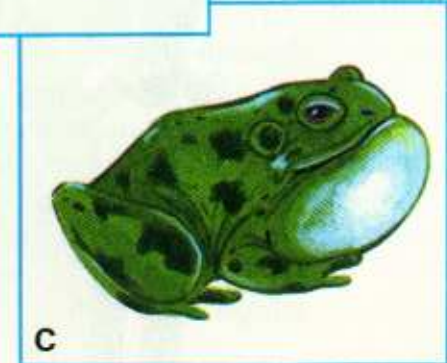
A

Bees buzz with their wings.



B

Bull-frogs use their voice-boxes to croak.



C

HOW DO WE HEAR SOUNDS?

We hear sounds with our ears of course! Ask your friend to clap his hands. Cover your ears. Can you hear your friend clapping? Ask your friend to blow his trumpet. Can you hear the blare of the trumpet? Cover your ears. What do you notice now?



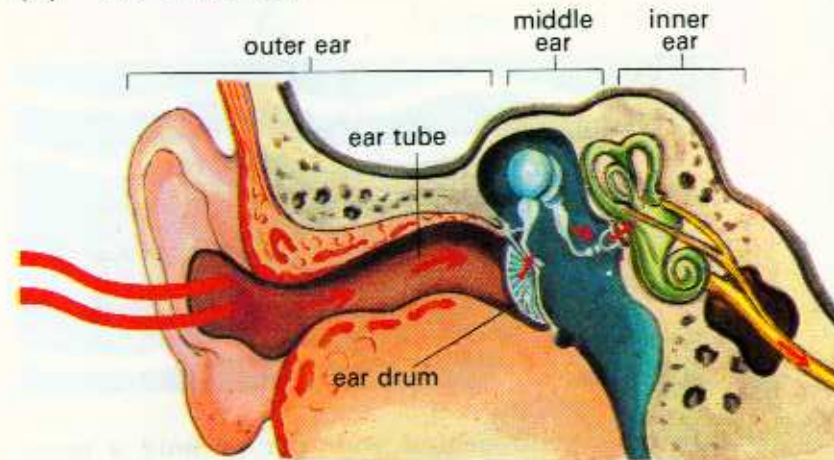
You hear sounds with your ears.



You have read that sound makes air vibrate, thus making sound waves. Before you can hear the sound, the sound waves must reach your ears.

Our ears are made up of three parts:

- (1) the **outer ear**,
- (2) the **middle ear** and
- (3) the **inner ear**.



Parts of the ear

How does sound reach your ears? Most of the sounds you hear come through the air. These sounds are brought to you by vibrating air. Vibrating air makes your **ear drums** vibrate. This makes some tiny bones in your middle ears vibrate. The bones, in their turn, make your inner ears vibrate. **Nerves** in the inner ears send messages to your brain. From these messages you can hear and recognize the type of sound that enters your ears.

Look after your ears! Do not push anything into your ears as you may break your ear drums!

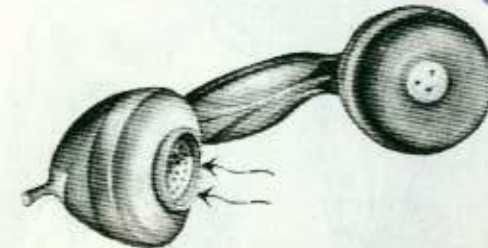
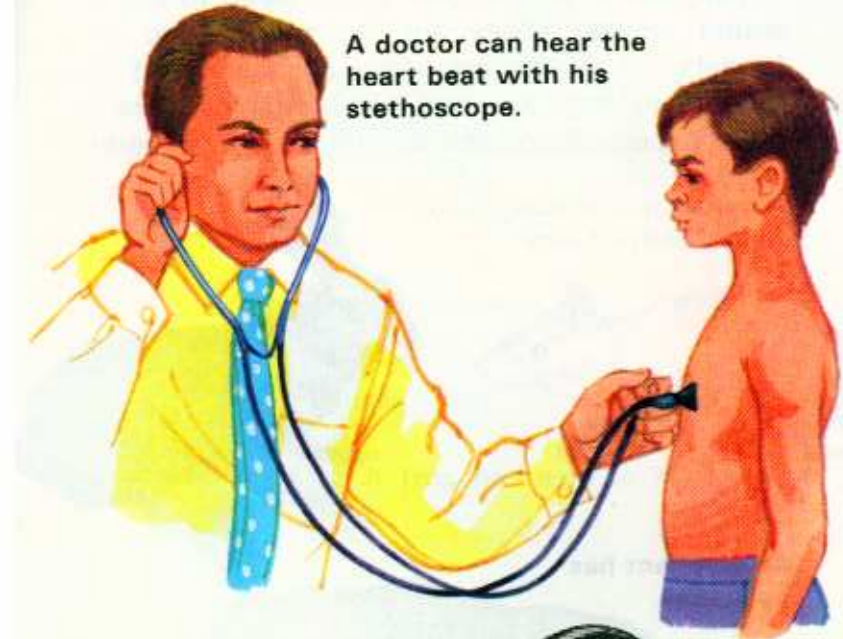
When we want to hear something more clearly we cup our hands behind our ears. In this way, we can collect more sound waves. So we can hear more clearly. Make a paper funnel. Hold it to one ear. Can you hear your teacher more clearly?



Cup your hand behind your ear or hold a paper funnel to your ear. Can you hear sounds more clearly now?



A doctor can hear the heart beat with his stethoscope.

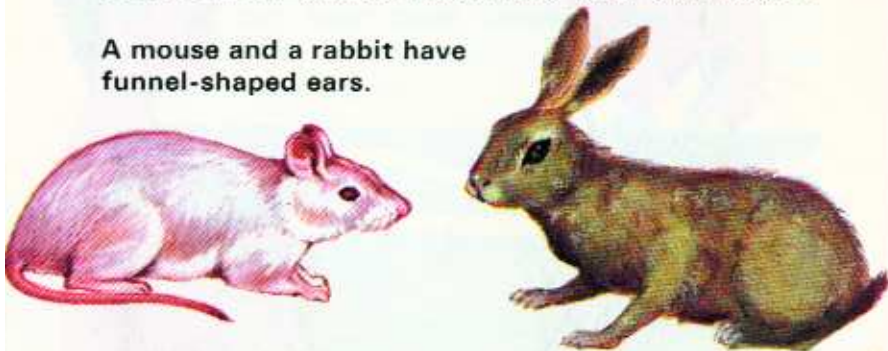


A telephone can collect sound waves.

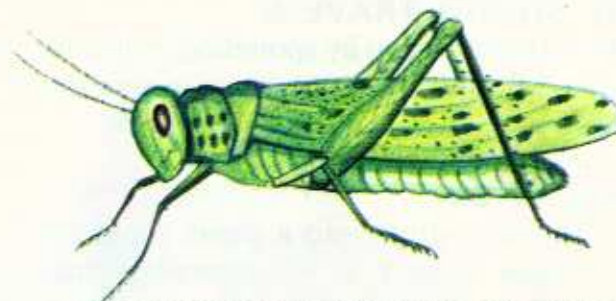
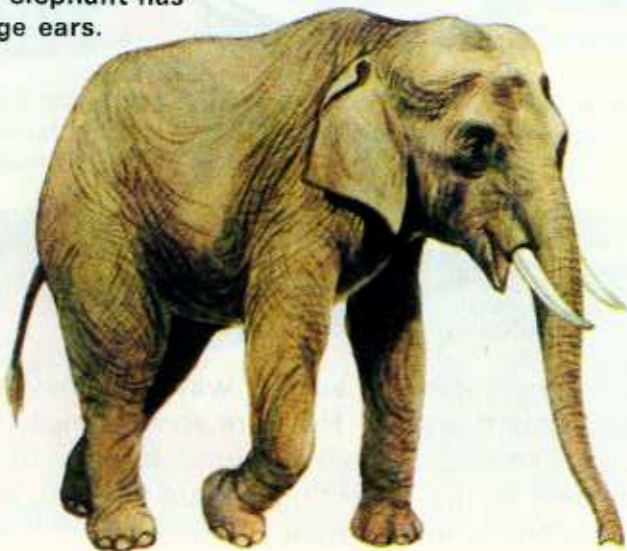
Ears are shaped in such a way that they can collect sound waves. Here are some things that are also shaped to collect sound waves. Make your own sound-collecting instrument with two funnels and a rubber tube.

The ears of animals are also shaped to collect sound waves. They are big and shaped like funnels. The ears of some animals stand up when they hear a sound. This enables them to collect more sound waves and thus hear better.

A mouse and a rabbit have funnel-shaped ears.



An elephant has huge ears.



A grasshopper has ears in its abdomen.



A frog has ears in its head.



The ears of a fish lie in a line in its body.

Some animals have ears which are not like ours. Some have very small ears. Most animals have ears on their heads but some have ears on other parts of their bodies.

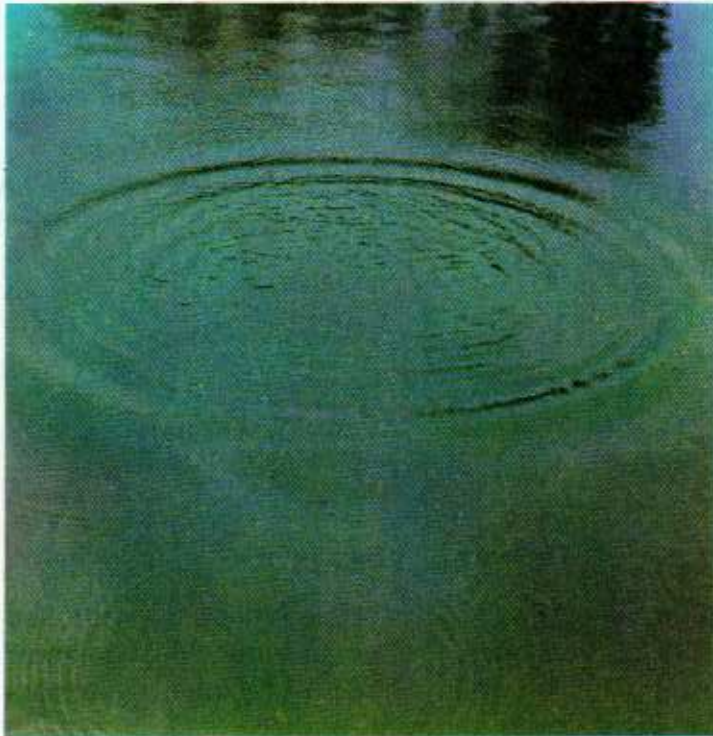
HOW SOUND TRAVELS

Sound reaches you by spreading in all directions at once. Sound does not move in one direction only.

Things to Do

- (i) Throw a stone into a pond. See how the waves spread in all directions from the centre. Sound moves in the same way.

Sound waves move like ripples.



All these children can hear the ticking of the clock. Does this show that sound waves spread in all directions?

- (ii) Put a clock on the table. Walk round the clock in a circle. In whichever position you are, you can still hear the ticking of the clock.
- (iii) Use a piece of wire and tie a bell to the cork of a bottle. Put the bell into the bottle and stopper the bottle as shown in the diagram on page 20. Shake the bottle. Listen

carefully. Now remove the cork. Use up some air from the bottle by burning a few pieces of paper in it. Quickly put the cork back. Shake the bottle again. Is the sound as loud as before? You cannot hear the bell so well now because there is less air in the bottle.



Can you hear the ringing of the bell? Is it louder when there is less air in the bottle?

Most of the sounds we hear are carried by air. The wind also helps to carry sounds from a great distance. Water can carry sounds too. It carries sound better than air.

Things to Do

- (i) Knock two stones together. The sound is carried by the air. Now knock the two stones under some water in a tub or basin. Press your ear to the tub or basin. Is the sound clearer and louder?



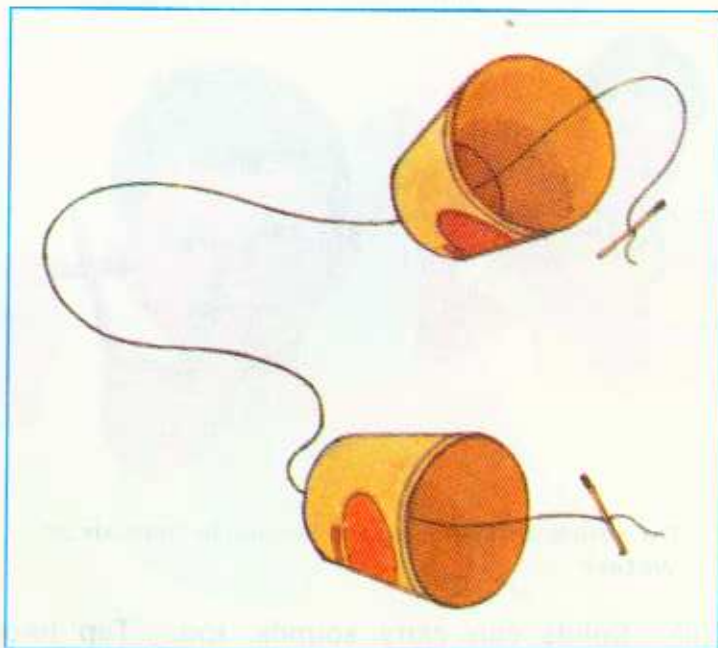
Do solids carry sound more clearly than air or water?

- (ii) Solids can carry sounds, too. Tap two pencils together. The sound is carried by the air. Now put one pencil to your ear. Tap it with the other pencil. Is the sound clearer and louder?

Solids can carry sounds more clearly than air or water. Therefore strings and wires can carry sounds for long distances.

Things to Do

You can make your own telephone. Take two empty ice-cream paper cups. Make a small hole in the centre of the base of each cup with a small nail. Now thread a long stout string through the holes.

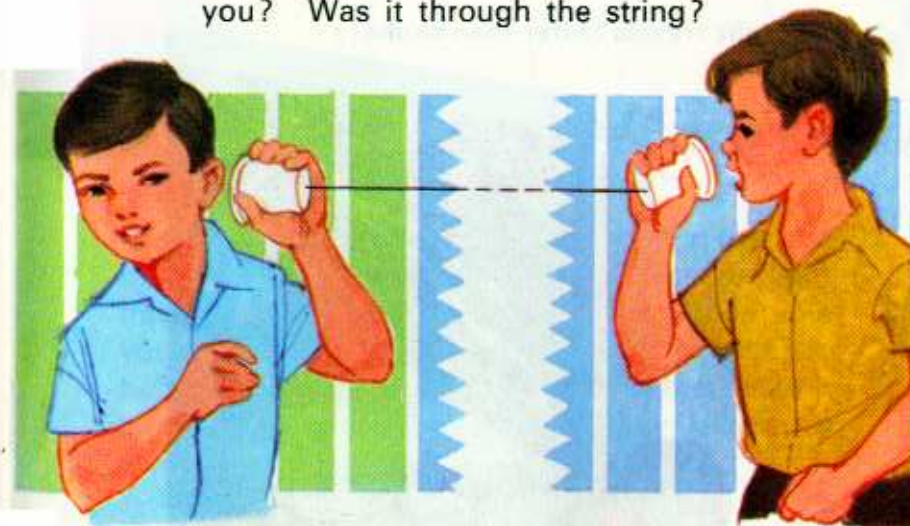


You can make your own telephone like this.

Tie a matchstick to each end of the string so that it will not slip through the holes. Ask your friend to take one of the cups and walk away from you to a distance far enough to stretch the string taut. Now

ask him to speak to you softly. Can you hear him clearly? Next, ask him to speak to you in the same soft voice but this time into the cup while you hold the other cup next to your ear. Can you hear him this time?

The sound made by your friend could not have travelled through the air far enough since you did not hear him the first time. You heard him only when he spoke into the cup. How did the sound travel to you? Was it through the string?



Sound travels through the string.

Now let your friend walk closer so that the string is slack. Ask him to speak into the cup again. Can you hear him now? What does this tell you?

HOW FAST DOES SOUND TRAVEL?

On your school sports day, have you ever noticed the starter of a race firing the starting gun? Do you hear the sound of the gun-fire first or do you see the flash of the gun first? What does this show?

Light travels very much faster than sound. That is why when a gun is fired the flash is seen long before the sound reaches us. Sound travels about one kilometre in three seconds. This is very fast indeed.

Light travels faster than sound.



This is how echoes are made.

In a thunderstorm you see the lightning first and then hear the thunder. This is because light travels very much faster than sound. Next time you see lightning, count the number of seconds before you hear the thunder. Divide this number by 3. This will tell you how many kilometres away the thunderstorm is.

Sound can also 'bounce' back like a rubber ball. When sound 'bounces' back it is called an **echo**.

Stand away from a high wall or cliff. Shout or clap your hands. The sound will travel to the high wall or cliff and 'bounce' back to you. Where else can you hear echoes?

LOW AND HIGH SOUNDS

There are different kinds of sounds. Some sounds are soft. Some are loud. Soft sounds are made by weak vibrations. Loud sounds are made by strong vibrations. Some sounds are low while others are high. Low sounds are made by slow vibrations. High sounds are made by fast vibrations.

Things to Do

- (i) Take an empty biscuit tin. Place it upside down. Put some sand on it. Tap the tin very lightly with a ruler. The sand will jump slightly because the vibrations are weak. The sound is soft. Hit the tin hard. What happens?

To find out about soft and loud sounds



To find out about high and low sounds



- (ii) Place a bicycle upside down. Turn the wheel slowly and touch the spokes with a ruler. You will hear a low sound. Turn the wheel fast and touch the spokes with a ruler. What type of sound do you hear? You can also make low and high sounds with a comb.

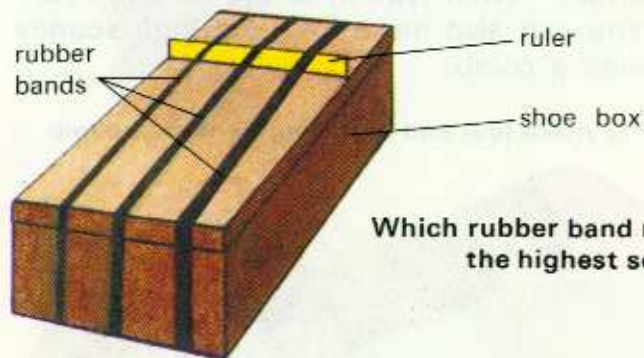
How to make low and high sounds with a comb



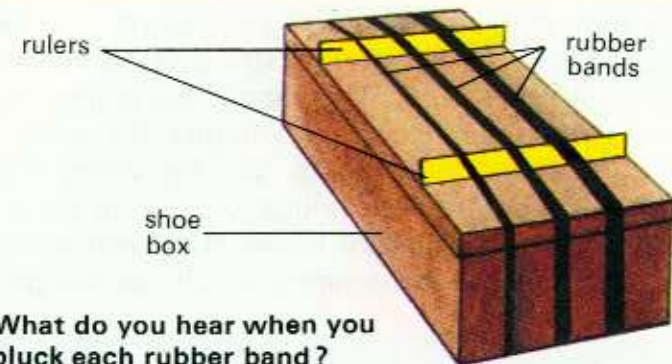


Which glass makes a higher sound?

- (iii) Take two glasses, one empty, the other filled with some water. Hit each with a pencil. Which makes a higher sound?
- (iv) You can also make low and high sounds by making a rubber band vibrate. Take three rubber bands of different thickness. Put them round a shoe-box. Make a



Which rubber band makes the highest sound?



What do you hear when you pluck each rubber band?

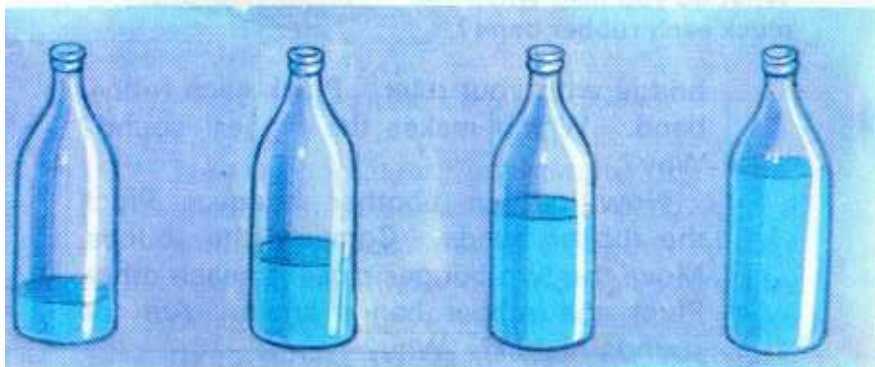
bridge with your ruler. Pluck each rubber band. Which makes the highest sound? Why?

Now put in another bridge. Pluck the rubber bands. Compare the sounds. Move the two bridges closer to each other. Pluck the rubber bands again. Are the sounds higher? Why?

Do you know how to make low and high sounds on these instruments?



A thin string makes a higher sound than a thick string. The tighter a string is stretched, the higher the sound. The shorter the string, the faster the vibrations and the higher the sound. Certain musical instruments, like the violin and the harp, make use of strings of varying thickness to produce musical notes. Can you name any other musical instruments which use strings?



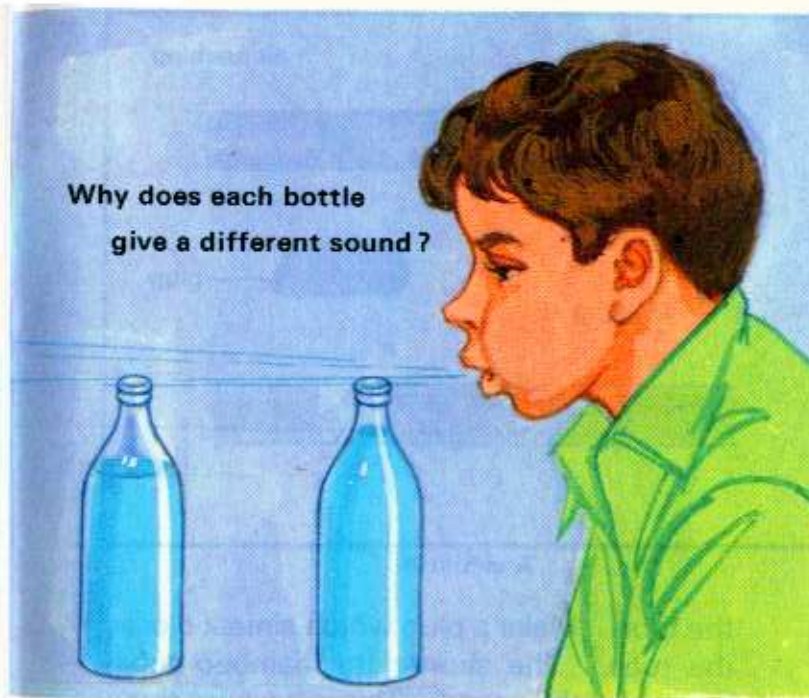
SOUNDS FROM AIR

Strings and other solids are not the only things that can vibrate. Air can also vibrate.

Things to Do

Find some bottles that are all of the same size. Fill them with water as shown in the above picture. Blow over them one by one as the boy is doing in the picture. The bottle with the most water will give the highest sound. This is because it

Why does each bottle
give a different sound?

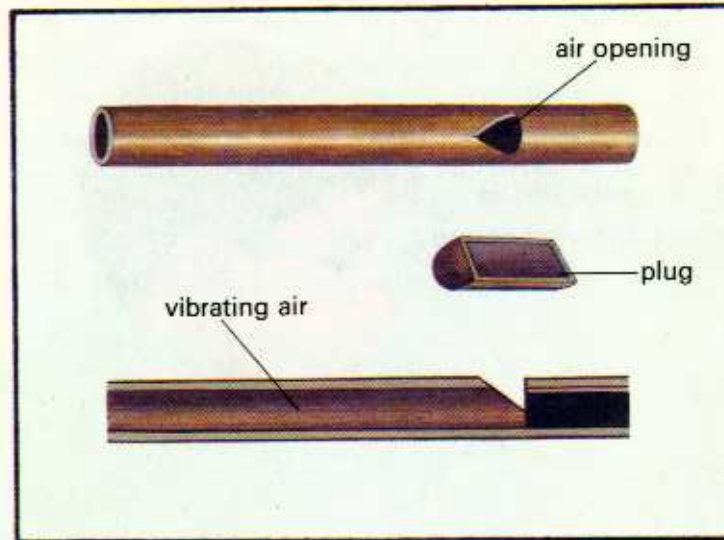


has the least amount of air. When the bottle has less air, the air vibrates faster and so a higher sound is produced.

Whistles make sounds because the air in them vibrates. A whistle is a tube with an opening. As air is blown past this opening it makes the air in the whistle vibrate.

Things to Do

Make your own whistle from a piece of bamboo. Cut an opening in the side of



A whistle

the tube. Make a plug which almost closes the tube. The shorter the bamboo tube, the higher the sound. This is because there is less air in a short tube.

Now you know how we make different sounds. Some sounds are pleasant to hear. Some sounds are unpleasant to hear. Name some pleasant and unpleasant sounds.